



STATE OF WASHINGTON

## STATE BUILDING CODE COUNCIL

### Washington State Energy Code Development Standard Energy Code Proposal Form

050  
TAG Modification  
6/10/22

Log No. Revised 050 Rec'd 6/02/22

Code being amended: ☐ Commercial Provisions ☒ Residential Provisions

#### Code Section #:

Brief Description:

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

Add Options 3.7 and Option 3.8 for air-to-water heat pump systems for 1.0 credits ~~and 1.5 credits~~, respectively, for "All Other" occupancies to read:

Option 3.7: Air-to-water heat pump with minimum COP of ~~2.83.2~~ at 47°F, rated in accordance with AHRI 550/590 by an accredited or certified testing lab.

Option 3.8: ~~Air to water heat pump with minimum COP of 3.2 at 47°F~~, as verified by an independent third party testing lab.

#### Purpose of code change:

Your amendment must meet one of the following criteria. Select at least one:

- |  |   |
|--|---|
| <input type="checkbox"/> Addresses a critical life/safety need.  | <input type="checkbox"/> Consistency with state or federal regulations. |
| <input type="checkbox"/> The amendment clarifies the intent or application of the code.  | <input type="checkbox"/> Addresses a unique character of the state.     |
| <input checked="" type="checkbox"/> Addresses a specific state policy or statute.<br>(Note that energy conservation is a state policy) | <input type="checkbox"/> Corrects errors and omissions.                 |

Check the building types that would be impacted by your code change:

- |   |   |  |
|---|---|--|
| <input checked="" type="checkbox"/> Single family/duplex/townhome | <input type="checkbox"/> Multi-family 4 + stories | <input type="checkbox"/> Institutional |
| <input checked="" type="checkbox"/> Multi-family 1 – 3 stories    | <input type="checkbox"/> Commercial / Retail      | <input type="checkbox"/> Industrial    |

Your name	Carolyn Roos	Email address	roosc@energy.wsu.edu
Your organization	WSU Energy Program	Phone number	360-956-2056
Other contact name	Jonathan Jones		

## Economic Impact Data Sheet

Is there an economic impact: ☐ Yes ☒ No

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants, and businesses. If you answered "No" above, explain your reasoning.

Energy savings could be achieved regionally by removing the current barrier to high efficiency cold climate air-to-water heat pumps (reverse chillers) in residential sizes. These units are currently excluded from achieving Option 3 credits despite their high efficiency by the requirement for an HSPF rating. This provides a high efficiency electric option for homeowners wanting a hydronic, radiant system when natural gas is not available.

Examples of air-to-water heat pumps in sizes less than 65,000 Btu/h that do not have HSPF ratings, but do have COP ratings are:

- <https://www.arcticheatpumps.com/arctic-heat-pump-020a-29-000-btu.html>
- <https://www.arcticheatpumps.com/arctic-heat-pump-040a-48-000-btu.html>
- <https://www.arcticheatpumps.com/arctic-heat-pump-060a.html>
- <https://www.chiltrix.com/>
- [https://hvac.place/SpacePak--LAHP48--4-Ton-Low-Ambient-Heat-Pump-Chiller\\_p\\_28.html](https://hvac.place/SpacePak--LAHP48--4-Ton-Low-Ambient-Heat-Pump-Chiller_p_28.html)

Provide your best estimate of the **construction cost** (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). **Webinars on the tool can be found [Here](#) and [Here](#)**)

\$01.9/square foot (For residential projects, also provide \$4,100/ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

Unit cost for a 4 ton cold climate air-to-water heat pump with stand per Arctic Energy site is approximately \$6,100. <https://www.arcticheatpumps.com/buy-cold-climate-heat-pump/heat-pumps-evi-low-temp.html>  
Assumed unit cost for baseline electric resistance boiler is \$2,000.

Provide your best estimate of the **annual energy savings** (or additional energy use) for your code change proposal?

5.8 KWH/ square foot (or) [Click here to enter text](#).KBTU/ square foot

(For residential projects, also provide [Click here to enter text](#).KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

The UA including envelope and infiltration losses for the C2200 medium dwelling unit prototype meeting Option 1.3 is 536 Btu/h/ft<sup>2</sup>. The COP as a function of OSA for Arctic Energy 050ZA/BE, 4 ton air-to-water heat pump is shown in Table 2 and Figure 1. The building heating load was calculated for each hour using hourly temperature data for Spokane, WA assuming:

- Baseline is similar hydronic radiant system with electric resistance boiler.
- COP is calculated as linear interpolation between COP data points in Table 2 as shown in Figure 1. COP of this unit is 3.2 at 47°F with average during heating season of 3.18 using Spokane hourly data.
- Heating load is calculated as  $Q=UA*(T-T_{out})$  where T is either the assumed balance point of 60°F or the setback temperature of 55°F from 10 pm to 6 am and 11 am to 4 pm.
- Heating energy is calculated as  $E=Q/COP$ . It is assumed parasitic loads are equal in the two cases.

**Instructions:** Send this form as an email attachment, along with any other documentation available, to: [sbcc@des.wa.gov](mailto:sbcc@des.wa.gov). For further information, call the State Building Code Council at 360-407-9255.

**All questions must be answered to be considered complete. Incomplete proposals will not be accepted.**

- In life cycle cost analysis, electricity unit cost of \$0.12/kWh is used.

**Table 1. Estimated heating energy savings for ATW heat pump compared to baseline of electric resistance**

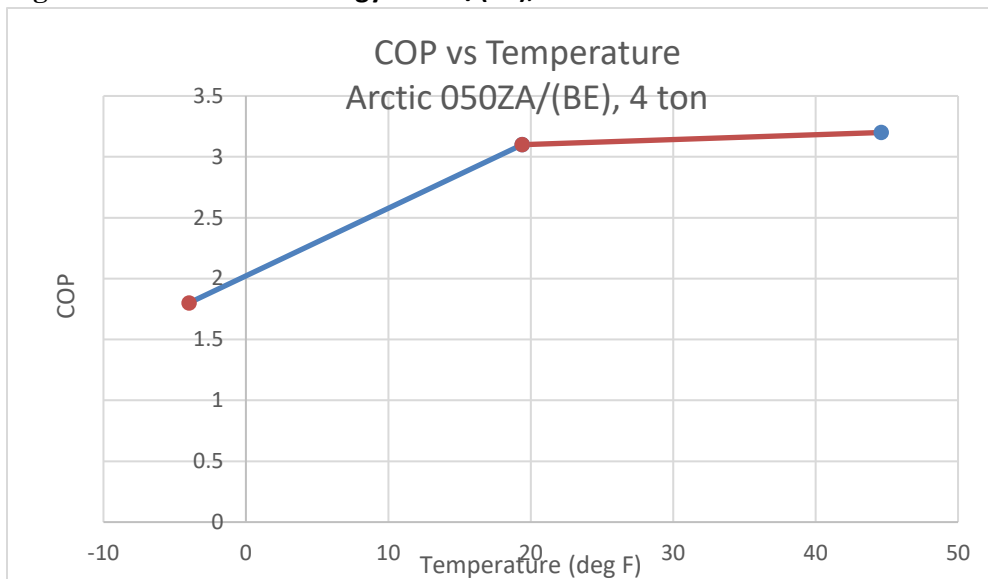
	Annual Energy Use		Savings (kWh/yr)
	ER Baseline (kWh/yr)	ATW Heat Pump (kWh/yr)	
CZ4C - Seattle, WA	9,857	3,090	6,767
CZ5B -Spokane, WA	18,581	5,898	12,683

**Table 2. COP of Arctic Energy 050ZA/(BE), 4 ton**

Temperature (deg F)	COP
44.6	3.2
19.4	3.1
-4	1.8

Source: <https://www.arcticheatpumps.com/specifications.html>

**Figure 1. COP of Arctic Energy 050ZA/(BE), 4 ton**



The baseline for comparison is radiant heat with electric resistance boiler.

**Table 3. Life cycle cost analysis results for Spokane with baseline of**

Life Cycle Cost Analysis		BEST
Alternative	Baseline	Alt. 1
Energy Use Intensity (kBtu/sq.ft)	28.8	19.7
1st Construction Costs	\$ 2,000	\$ 6,100
PV of Capital Costs	\$ 5,944	\$ 18,130
PV of Maintenance Costs	\$ -	\$ -
PV of Utility Costs	\$ 94,895	\$ 64,773
<b>Total Life Cycle Cost (LCC)</b>	<b>\$ 100,839</b>	<b>\$ 82,903</b>
<b>Net Present Savings (NPS)</b>	<b>N/A</b>	<b>\$ 17,936</b>

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List any **code enforcement** time for additional plan review or inspections that your proposal will require, in hours per permit application:

Code enforcement time for plan review or inspection would not be increased. Code enforcement time may be reduced by eliminating what is perceived by the public to be an arbitrary barrier to high efficiency systems.

**Small Business Impact.** Describe economic impacts to small businesses:

None

**Housing Affordability.** Describe economic impacts on housing affordability:

None. These are optional alternatives for homeowners wanting efficient hydronic radiant heating in locations where natural gas is not available.

**Other.** Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

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